THE INFLUENCE OF AN INTEGRATED MATH, SCIENCE AND TECHNOLOGY EDUCATION PROGRAM ON STUDENTS' PERFORMANCE ON THE STATE OF OHIO MATH AND SCIENCE SUB-SECTIONS OF THE 9TH GRADE PROFICIENCY TEST IN A SELECTED HIGH SCHOOL.

DISSERTATION

Presented in Partial Fulfillment of the Requirements for
the Degree of Philosophy in the Graduate School
of The Ohio State University

By

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*****

The Ohio State University
2000

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ABSTRACT

The primary purpose of this study was to investigate the relationship of the integration of math, science, and technology education on student performance on the math and science sub-sections of the Ohio standardized proficiency test. This study examined three research questions and ten hypotheses that were formulated around the three questions. The target population was all eleventh grade students at a large Ohio suburban high school. This group was followed when they were in the ninth (97-98), and the tenth grades (98-99), in order to see when they passed the standardized proficiency test. Students were divided into two groups. The treatment group consisted of students in the integrated math, science, and technology education program. The control group consisted of the students in the non-integrated math, science, and technology education program.

The research started with three 310 students in the eleventh grade. Sixty-eight students were in the integrated math, science, and technology education program, and 242 students were in the non-integrated math, science, and technology education program. After screening the students, the researcher limited the study to those students who were enrolled in January of 2000 and who attended classes regularly. Students with
poor attendance, expelled students, developmentally disabled students, and suspended students were excluded. In the end, the final count of students was 58 students in the integrated math, science, and technology education program and 221 students in the non-integrated math, science, and technology education program.

Students who had two or more courses in the integrated math, science, and technology education program scored significantly higher on the science sub-section of the standardized proficiency test than students who did not have any integration. This difference was also observed when male students were compared. Also, all students who had the integrated math, science, and technology education program required fewer attempts to pass the math and science sub-sections of the Ohio standardized proficiency test. That also, indicated a possible positive effect of the integration of math, science, and technology education program.
Dedication

To my entire family, for their love, patience, support, and understanding.
ACKNOWLEDGMENT

First of all, I am thankful to God for giving me the opportunity to pursue my educational goals and to fulfill one of my childhood dreams. Without his help I do not believe that I could have made it this far, or could I imagine seeing myself writing this acknowledgment on this wonderful spring night.

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Last but not least, I would like to thank my entire family for their love, patience, support, and understanding. Without you I would not be here and with you I have achieved my dream.
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CHAPTER 1
INTRODUCTION

The concept of integrating disciplines to best motivate students to learn and better understand important concepts is nothing new to industrial arts/technology education. “Education about technology, science, and mathematics is part of the historical basis of American education and industry” (Sinn, Waltour, & Haren, 1993, p.3). Schweickhard (1929) discussed the educational need for real world applications of mathematics and the role of industrial arts in fulfilling that need.

“Science and mathematics are important to understand the processes and meaning of technology. Their integration with the technology education curriculum is vital” (Fenn, 1992, p.4). Educators and schools have different perspectives of how math, science, and technology classes should be conducted (Waldrip, 1994). On the other hand, Waldrip (1994) argues that the cultural backgrounds of students will play an important role in how much information students can obtain. However, learning strategies have been developed which provide the right environment for students to understand the subjects that are being taught to them. “There is substantial evidence which indicates that teachers can make a more substantial difference to student’s achievement, attitude and motivation if the teachers relate the subjects to the environment that the students come from” (Waldrip, 1994, p.2).
With the emergence of proficiency testing and schools being held accountable for passing scores, new ways of teaching and motivating students must be presented. Districts are scrambling to get test scores up, particularly in math and science, since American students have traditionally scored low in math and science sub-sections of the proficiency test. Gender, ethnicity, and socioeconomic status could play a big role in students’ level of performance. Students could face some kind of discrimination and harassment from their classmates or teachers based on gender, ethnicity, or socioeconomic status that could jeopardize their level of performance (Dowson, 1998, p.18). Whatever the case may be, educators believe that students who are exposed to an integration of math, science, and technology education will achieve higher scores on the standardized proficiency test, than those who are not exposed to such an integration (Wiggins, 1993).

**Problem Statement**

The integration of math, science, and technology education progressed a long way during the 1990s. However, information still needs to be gathered and questions answered regarding the effectiveness of such integration. Teachers who integrate math, science, and technology education within their classrooms expect their students to achieve higher scores on the standardized proficiency test than those who do not have integration. There is not enough available data to support the theory that an integration of math, science, and technology will help students to understand school subjects better and raise their standardized proficiency test scores.
**Purpose of the Study**

The purpose of this study was to investigate the relationship between the integration of math, science, and technology education and student understanding. Also, an attempt was made to verify the theory that the integration of math, science, and technology education has a positive impact on the math and science sub-sections of the Ohio standardized proficiency test scores.

**Questions of the Study**

The research questions for this study were:

1- Does the integration of math, science, and technology education in a selected Tech-prep program have an effect on the math and science sub-sections of the Ohio standardized proficiency test?

2- Does the integration of math, science, and technology education affect the math and science sub-sections scores of the Ohio proficiency test based on gender?

3- Does the integration of math, science, and technology education affect the math and science sub-sections scores of the Ohio proficiency test based on ethnicity or race?

**Hypotheses**

1.1- Students who had one course of the integrated math, science, and technology education program will have higher math and science sub-sections of the Ohio standardized proficiency test scores, than those students who did not have any integrated program.
1.2- Students who had two or more courses of the integrated math, science, and technology education program will have higher math and science sub-sections of the Ohio standardized proficiency test scores, than those students who did not have any integrated program.

1.3- Students who had two or more courses of the integrated math, science, and technology education program will have higher math and science sub-sections of the Ohio standardized proficiency test scores, than those students who had one integrated course.

2.1- Female students who are in the math, science, and technology education integrated program will have higher math and science sub-sections of the Ohio standardized proficiency test scores than those female students who are not in the integrated program.

2.2- Male students who are in the math, science, and technology education integrated program will have higher math and science sub-sections of the Ohio standardized proficiency test scores than those male students who are not in the integrated program.

3.1- African-American students who are in the math, science, and technology education integrated program will have higher math and science sub-sections of the Ohio standardized proficiency test scores than African-American students who are not in the integrated program.

3.2- Caucasian students who are in the math, science, and technology education integrated program will have higher math and science sub-sections of the Ohio
standardized proficiency test scores than Caucasian students who are not in the integrated program.

3.3- Hispanic students who are in the math, science, and technology education integrated program will have higher math and science sub-sections of the Ohio standardized proficiency test scores than Hispanic students who are not in the integrated program.

3.4- Asian students who are in the math, science, and technology education integrated program will have higher math and science sub-sections of the Ohio standardized proficiency test scores than Asian students who are not in the integrated program.

3.5- American-Indian students who are in the math, science, and technology education integrated program will have higher math and science sub-sections of the Ohio standardized proficiency test scores than American-Indian students who are not in the integrated program.

Assumptions

This study was predicated upon the following assumptions:

1- The subjects selected for this study were a representative population of high school students in Ohio.

2- The subjects selected for this study were representative of ethnic groups in Ohio.

3- The technology education program involved for this study was representative of high school technology education programs in Ohio.
4- The science education program involved for this study was representative of high school science education programs in Ohio.

5- The mathematics education involved for this study was representative of high school science education programs in Ohio.

6- The integrated math, science, and technology education program involved for this study was representative of high school integrated math, science, and technology programs in Ohio.

7- Subjects who participated in this study were enrolled in at least one mathematics education course at the time of the study.

8- Subjects who participated in this study were enrolled in at least one science education course at the time of the study.

9- The subjects selected for this study are representative of a larger population of high school students in Ohio.

Limitations

The study was constrained to the following limitations:

1- The research was limited to those students naturally progressing from grades 9, through 11 at the target high school.

2- The study was limited to students who were enrolled in January of 2000, except for students who were excluded for poor attendance, suspension, expulsion or being developmentally disabled.
3.- Students in the treatment group were self selected, which could threaten the internal validity of this study.

4.- The study was limited to students who were not qualified as developmentally disabled.

5.- The study was limited to students who attended class regularly.
Definition of Terms

Performance Level

Constitutive Definition: Performance is defined as, "A standard on which a judgment or decision may be based" (Webster's Dictionary, 1989, p.559). Level is defined as, "Spectrum on which is represented the degree to which a learner merges new stimuli with older ones stored in memory" (International Dictionary of Education, 1980, p.469). Performance level can therefore be defined as, students' ability to comprehend and show understanding of the school subjects.

Operational Definition: Performance level will be operationally defined as, the separate mean score on the Ohio proficiency tests for math and science. The test consists of 100 items that are used to determine students' level of understanding in the areas of math and science. The test will be multiple choice. The score of the proficiency test for the integrated program will be compared to a non-integrated program, in order to test the hypotheses.

Level of understanding

Constitutive Definition: Level is defined as, “Spectrum on which is represented the degree to which a learner merges new stimuli with older ones stored in memory” (International Dictionary of Education, 1980, p. 469). Understanding is defined as, “The power to think and learn; intelligence” (International Dictionary of Education, 1980, p.821). Level of understanding can therefore be defined as, students’ ability to
comprehend the school disciplines.

**Operational Definition**: Level of understanding will be operationally defined as the mean score on the Ohio proficiency test. Students who score 90% or more have a higher level of understanding. Students who scores 80-89% have an above average level of understanding. Students who scores 70-79% have an average level of understanding. Students who scores 60-69% have a below average level of understanding. Students who scores below 59% have failed to understand.

**Integrated Program**.

**Constitutive Definition**: Integration is defined as, “To make or become whole or complete” (Webster’s Dictionary, 1989, p. 317). Program is defined as, “Plan or procedure for dealing with some matter” (New World Dictionary of American English, 1988, p. 477). Integrated program can therefore be defined as, students’ ability to understand and comprehend math, science, and technology as a combined discipline.

**Operational Definition**: An integrated program will be operationally defined as, those students enrolled in the tech-prep classes in the selected high school.

**Tech-Prep**.

Is defined as “a competency-based program of combined high school and 2-year college education and (in many cases) occupational experience. Tech Prep programs give students a common core of required proficiency in mathematics, communications (English), science, and technologies” (Ohio Department of Education, 1997, P.36).
Poor Attendance.

Is defined in this study as students missing more than eight days in a given semester.

Suspension.

Is defined in this study as students being suspended for more than eight days in a given semester.

Expulsion.

Is defined in this study as students being expelled for a whole semester.

Developmentally Disabled.

“A disability which is attributable to mental retardation, cerebral palsy, autism, epilepsy, a learning disability related to a brain dysfunction or a similar condition found by comprehensive evaluation to be closely related to such conditions, or to require habilitation similar to that required for mentally retarded persons” (Ohio Department of Education, 1997)
CHAPTER 2
LITERATURE REVIEW

Introduction

The idea of integrating math, science, and technology education has been on the rise in the last several years. Taking students from the lecture atmosphere, where each subject is taught separately, to an atmosphere where mathematics, science, and technology education are integrated, will contribute to the amount of knowledge students gain.

But what makes the integration of math, science, and technology education so important? As Foster stated, “The integration of math, science, and technology is the most typical form of integration that has been presented to the technology teacher” (Foster, 1994, p.2). By integrating math, science, and technology education, students will understand the subjects better; it provides them with hands-on activities, which enhances their learning, instead of only lectures. “Technology education appears to interface with mathematics and science. It has the hands-on activities described by math and science educators” (Foster, 1994, p.3).

How is each discipline dependent upon the other? Science is dependent upon technology to test, experiment, verify and apply many of its research, laws, principles,
and knowledge base. “Math provides us with the analytical tools to create, alter and build our world” (Dugger, 1994, p.4). No one can measure or build without it.

Are these new concepts or new curriculum ideas in education? Certainly not, applied integration of subjects has been discussed for decades. It just has never been implemented on a wide scale, which in turn, has caused a shortage of truly credible research on the subject.

How can we motivate students towards science, mathematics, and technology? The idea of math, science, and technology will convert what students have learned in school into their own environments and communities. Therefore, it will motivate the students to understand the subjects better (Flint, 1993). By combining learning in school with the environments, teachers will help the students to:

1- Build paths to success: The student will be able to understand what is going on around them regarding science, math, and technology education. Also, students will be able to meet different individuals that they will learn from.

2- Facilitate identifications with the task of school: Teachers should introduce the benefits of math, science, and technology to students so they can relate concepts they learn to either math, science, or technology education.

3- Encourage students to enjoy school: Teachers should encourage students to enjoy school and to work hard, in order to reach their goals.

4- Assist students in understanding their community and making a connection between what they have learned and what is happening within their communities. For example,
visiting agencies such as gas companies or hospitals to learn about technologies they use. Assist students in using scientific process skills. For example, students may be asked to identify what kinds of noises are present in their neighborhoods.

6- Students can be encouraged to solve problems such as recycling. Furthermore, this will encourage parents to be more involved with their children in cooperative efforts to solve community problems, resulting from the impact of science and technology. This shows that students can learn more by involving what they have learned in school to within their communities. Thereby, students will learn the subjects much better (Flint, 1993).

What is the history behind integrating math and technology education? In the beginning of this century, industrial arts teachers began integrating mathematics and science concepts into their curricula (Foster, 1994). Also, they found that students enjoyed the idea of integrating these subjects together, by showing improvements in their test scores and their interactions in the classrooms. In Bosner and Mossman’s Industrial Arts for the Elementary School (1923), they discussed in detail projects which would serve to integrate the school subjects. By the 1960’s, the emphasis of math, science, and technology integration in the industrial arts became increasingly involved (Saligrama, 1992).

**Hands-on approach**

The educational approach of industrial arts and now technology education has always been a hands-on approach. Only in recent years have other disciplines such as mathematics and science, begun to use this educational methodology. Educators
are realizing the value of the hands-on approach in terms of motivation and test scores. “Research indicates that rote memorization learning yields approximately ten percent retention by most learners” (Jeldon, 1974, p.12). “That figure can be increased dramatically by introducing a kinesthetic (hands-on) approach augmented with technology” (Pedras, 1992, p. 22).

Mathematics and science takes on new meaning when introduced with the hands-on technology approach. For example, mathematics comes to life when a computer is used to demonstrate practical problems. Programs, such as Craftsmanship-2000 (C-2000), are at the forefront of applied hands-on learning. This school-to-work program incorporates applied, hands-on learning in math, science, and physics in relationship to the mechanical processes.

**Problem solving**

Technological problem solving and critical thinking skills are becoming increasingly important in today’s ever-changing world. The new “buzz” word in education seems to be the problem solving approach. This approach utilizes the scientific method to help achieve the desired results. According to Robert, “All students should be taught to reason, to design models, to create, and to solve problems” (Roberts, 1994, p.145). Ortega and Ortega (1995) stated, “integrated technology education encourages and enables students to be curious and creative and develop their problem solving skills” (p.12).

Students need to know the benefits of an integration of math, science, and technology education in their daily lives in order to understand it. Jacobs stated, “There
is a need to actively show students how different subject areas influence their lives, and it is critical that students see the strength of each disciplines perspective in a connected way” (1989, p.5). In addition, when math, science, and technology education are integrated students have the ability to apply the disciplines to real world situation (Davison, D.M., Miller, K. W., & Metheny, D.L., 1995). “The focus should be on designing a curriculum that is relevant, standards based, and meaningful for students. At the same time, the curriculum should challenge students to solve real world problems” (Loepp, 1999, p.21). Loepp (1999) created a module that was based on problem solving. This module was designed to challenge students’ abilities to solve problems. Teacher and students work together in order to come up with a solution for a particular problem. The integrated Technology, Science, and Mathematics (T/S/M) that was developed by LaPorte and Sanders (1993) based the integrated concepts from this module.

By examining the NCTM standards of 1989, which was based on teachers, inspiring students with the concepts of problem solving. The NCTM standard advocates the constructivist approach to teaching and learning. “Young children are active individuals who construct, modify, and integrate ideas by interacting with the physical world, materials, and other children” (NTCM, 1989, p.17). Loepp (1999), encouraged teachers to use models in their classrooms as a way of integrating math, science, and technology. Students will study the model and figure out a way to solve the problem that was introduced to them. By doing so, models stimulate students’ intellectual processes (IMaST, 1997; Meier, Hovde, & Meier, 1996).

Technology education challenges students’ intellectual thinking and the ability to
be creative. "The fact that technology is associated with those who do manual work, whereas the education system is largely controlled by those who do not, has tended to give technology a lower status in education than science" (Carelse, 1988, p. 101). While science education tries to teach students about the natural world, and the law of the universe, technology education teaches students how to alter the material world (Custer, 1996, p.8). Bensen (1995) states,

"Technology is everywhere and it is an integral part of how and where people live, work, recreate, and socialize. Without technology, humans are extremely limited in what they can accomplish, but with it, humans are able to exert virtually unlimited power and energy in reaching their full potential" (p.1).

Integrating math, science, and technology will enable students to have the essential skills to make it in the real world.

"There are certain "thinking and doing" skills associated with science, mathematics, and technology that young people need to develop during their school years. There are essential skills for formal and informal learning and for a lifetime of participation in society as a whole. Taken together skills can be thought of as habits of the mind, because they all relate to a person’s outlook on knowledge and learning and ways of thinking and acting" (McCade and Weymer, 1996, p. 42).

There is a connection between students’ level of curiosity and their problem solving ability and the integrated math, science, and technology education program (Brusic, 1991 & Childress, 1996). On the other hand, Childress (1996) is pessimistic
about the effects of the integration of math, science and technology education program on students achievement level.

Typically, in a TSM problem-solving activity there will be a winner chosen through a competitive project contest. Unfortunately, many times the students who loses even wins does not fully understand why that occurred. Answers to many of these questions must rely on mathematics and science to explain. For example, in an activity in the TSM curriculum manual called Capture the Wind, an activity that presents the challenge of designing, building, and evaluating the device. The science instructor could discuss such topics as motion, pressure, force, wind energy, electrical, and so on. Students are engaged in the process of science and they are motivated because it is a hands-on applied activity. The mathematics instructor could teach subjects such as the diversion of pie, analyzing pitch, Ohm’s law, and distance calculations. Technology activities such as these that interrelate, make learning fun and relevant for students. When learning is fun, students are more likely to be self-motivated and put forth extra-effort.

“Tests have a large effect on what is taught. Administrators, teachers, and students will emphasize those abilities necessary do well on tests, and the pressures to do so as are becoming more intense” (Collins, 1991, p.4). Perry argued that teachers could make accurate judgments of students’ academic performances. Moreover, cooperative learning allows students to increase their performance and motivation within the classroom. “Students working in groups are more motivated than those who work alone, but performance in these settings is influenced by one’s affiliation motives” (Klein, 1993, p.4). On the other hand, providing rewards for students could motivate
students to work harder and achieve better grades (Klein, 1993). Students’ attention will be captured while working in groups, and their interests will be focused towards understanding the course material. While working in groups, students will learn valuable lessons in problem solving. Math, science, and technology will provide students with the right environment where they can use their skills and talents to solve problems. “The belief is that, with the rapid changes that are taking place in the world, students must be prepared in the new basics of problem solving decision making, critical analysis, reasoning and thinking skills, computer usage, and communication in addition to the basic knowledge required for usage of those skills” (Chanlin, 1994, p.10). Math, science, and technology provides students with the knowledge they need for everyday life (Chanlin, 1994).

**Collaboration**

“Technology has the potential to make a significant impact on education at all learning levels, but it will be only as powerful as the degree to which it is integrated effectively into the total instructional program” (Reeves 1988, p.1). The integration of math, science, and technology will establish leadership skills among students. Besides working collaboratively, the integration of math, science, and technology develops a sense of leadership within students. By working in groups, students will share the responsibility of the leadership. They will have the chance to make decisions regarding different aspects of problems. Students can choose a leader among themselves. Moreover, the responsibility of the leadership can change from one student to another. Sharing the role of responsibility will develop student’s self-esteem and confidence. Teachers also
can share the responsibility of assigning a leader for the groups if the teacher feels that some of the group members have been ignored. Having the leadership role will develop the students’ urge to be involved with assignments and group work. Moreover, this kind of leadership that math, science, and technology preserves within students, will reflect in all aspects of students’ lives inside and out side of the classroom. They will be more productive and well-rounded individuals in the sense of taking charge of situations.

Reynolds (1998) encourages collaboration cross disciplines such as math, science, and technology. Teachers should assist other teachers with innovative ways of delivering their instructions, and sharing information and strategies. Integrating math, science, and technology will require tremendous amounts of effort and collaboration from instructors. Students sometimes will need more clarification from instructors on how to use or perform certain tasks. Collaboration of teachers when using modules is very essential to the success of the integration. Students sometimes face difficulties understanding the purpose of the modules, therefore teachers’ assistance is very important to explain the main concepts, theories, and structural frameworks.

**Teacher Rule on the integration**

Math, science, and technology instructors should explain to their students the benefits of the modules and what knowledge they should gain from them. For example, in the rocket module, students will be studying the concepts of elevation, gravity, and velocity. Also, students will perform some mathematical calculations, in order to figure out the velocity and gravitational force. Without covering such concepts in the classrooms, students will have a difficult time understanding and digesting these
concepts. Teachers’ collaboration with these concepts will make the experience of integration a success. Students working together in technology labs will be very important to their understanding of concepts. Students can learn from each other while working in groups. It is true that teachers are the main provider of knowledge within classrooms. However, students can play a big role in helping their classmates overcome some difficulties. Some students do not feel comfortable asking instructors questions for one reason or another. These reasons may vary from shyness, embarrassment, or low self-esteem. Thus, when it comes to their classmates, these barriers dissolve and students feel more comfortable with their friends. Students can ask their classmates any questions without being embarrassed or made fun of. Students sometimes feel that when they ask teachers a question in front of everybody that they are considered as stupid or not as intelligent as the rest of the students. Therefore, by working in groups collaboratively, teachers allow students to learn from their mistakes. Also, collaboration opens an alternative door for students to exercise their talents.

Teachers should ask themselves, what could they do in order to enhance students learning with technology? What other teaching methods should they use? Teachers need to let students discover things by themselves, allowing them to have different experiences. Picking a proper method of teaching is not an easy task to accomplish; it is a difficult task to master. Teachers need to encourage their students to ask questions and to investigate what is going on around them. This kind of exploration will teach students to find the answer for themselves; by using trial and error methods. Some students will get the right answers and some will not. The point is, to learn from your mistakes. Doing
different activities in the technology lab will assure this type of exploration.

Technology will provide the tools and space for students to implement a variety of math and science concepts and theories. Schrum (1993) stated, “Technology has the potential to build on whatever skills a student possesses. When students' own interests drive the learning process, we find that they work longer and harder, they are more engaged in their learning, they are asking questions at whatever level they happen to be” (p.1). Working in the technology lab motivates and raises students’ interests and encourages them to achieve better grades. Math, science, and technology education teachers should be educated on what methods of teaching are appropriate for certain groups of students. Elementary school students have different levels of intellect than middle and high school students. Therefore, math, science, and technology teachers need to design different methods of instructions.

Pape (1998) argued that a great number of students have a hectic time understanding algebraic concepts. Therefore, math teachers need to come up with different methods of teaching in order to deliver their instructions. Pape (1998) thinks that technology education can be the solution for such problems. The integration of math and technology could reflect positively on students’ understanding of mathematical concepts thoroughly. The use of technology tools and processes in classrooms will contribute significantly on students’ understanding.

**The Achievement test**

Dowson (1998, p.5) stated, “Any test that measures the attainments or accomplishments of an individual after a period of training is called an achievement test.”
The history of the achievement test goes back as far as the 1840s; when Horace Main wrote an examination for use in Boston. New York shortly followed in 1865. In 1897, Joseph Rice conducted an achievement test to study the effects of spelling and the time spent learning how to spell. The college entrance exams began in 1900, in order to examine the students' level of knowledge. Years later, Thorndike and his students constructed the standardized achievement tests for elementary and high school students (Dowson, 1998).

Dowson mentioned, that the main purpose of conducting achievement tests is establishing grades. Establishing grades is one of the most important aspects of conducting the achievement test. It distinguishes the honor students from the rest of the students. Second, is diagnosis, which reveals students' strength and weaknesses. Also, the diagnosis gives an overall picture of the instructor's teaching methods and his/her ability to deliver the information to students. Third is sectioning, students who achieve higher scores on the achievement tests can be advanced to higher-level courses, in order to polish their skills and talents. Fourth is consists of motivation. By looking at the integration of math, science, and technology, students' motivation plays an important role on how students perform in their course assignments and tests. Motivation and test results are positively correlated, indicating a strong bond between the two variables. Finally, there is the evaluation of teaching. Teachers can reflect on the test results to see their strengths and weaknesses and where they can do the adjustments, in order to provide better instructions (Dowson, 1998).
Background of the Ohio Standardized Proficiency Test

In 1985, the State of Ohio legislature passed a house bill 231 mandating that all Ohio students in the ninth grade should pass the standardized proficiency test, in order to obtain a high school diploma (Lanese, 1992). Beginning in 1990-91, all ninth grade students have to pass the minimum requirements of the proficiency test in the area of mathematics, reading, citizenship, and writing. In 1995, the science test was added to the standardized proficiency tests for the ninth grade (Ohio proficiency tests, 1995). Students will be given two chances each year during their four years in high school to pass the proficiency tests. The first test is usually conducted in October of each year; leaving the make-up tests until March (Ohio state legislative, 1993). All students in the ninth grade in the State of Ohio are required to take the standardized proficiency test. On the other hand, there are some exemptions given for disabled students, which excuse them from taking the proficiency test (Ohio proficiency tests, 1995).

Description of the Proficiency Test

The science portion of the ninth grade proficiency test emphasizes on students’ understanding of concepts, basic facts, and the ability to analyze and apply information. Forty percent of the questions will emphasize on the students’ acquiring scientific knowledge through examining their ability to make measurements, read labels, graphs, and charts. The other forty percent of the questions will focus on processing the scientific knowledge. This portion of the test will examine the students’ ability to interpret and analyze information through recognition of trends and patterns of data. Twenty percent of the science test will focus on extending the students’ scientific knowledge.
This section will test the students’ ability to apply knowledge and conceptualized understanding of new situations through developing models, drawing conclusions, predicting, asking and evaluating questions (Ohio proficiency tests, 1995).

The mathematics portion of the proficiency test consists of forty-five questions; five of the questions are sample questions. Students are given two and one-half hours to complete the test (Ohio ninth grade proficiency test instruction book, 1997). Students need to answer twenty-four correct answers out of the forty questions, in order to pass the mathematics section. Thirty percent of the mathematic test is designated for arithmetic encompasses, while measurements takes up twenty-five percent. Data analysis, geometry, and algebra are each fifteen percent of the test (Ohio department of education, 1989).

Students in Ohio’s Public Schools start preparation for the proficiency tests in kindergarten until the eighth grade. Some of the questions on the test could be drawn from sixth-grade math and science courses of study. Experts on the Ohio Board of Education imply that the best experiences students obtain during their school years are through hands-on experiences, not from textbooks or library references (Ohio proficiency tests, 1995). Lanese said, “The rationale behind the proficiency test is to maintain minimum standards and to guarantee certain skills for all Ohio public school graduates” (1992, p.4).

**Assessment of students’ performance**

Assessing students’ performances is an important topic among educators. What and how students perform in the classroom is a reflection of the teacher’s instructions. Mabry (1999) said:
“Content standards tend to be more general and more idealized than performance standards, telling what we hope students will learn or articulating aims we hope teachers are striving toward instruction. But there is confusion in the use of these terms. Frequently, personnel working with large-scale assessment programs describe these programs as having content standards but on inspection, the standards sometimes describe very specific performances and the levels by which they will be judged. That is, the so-called content standards are actually performance standards.” (p.62)

In some states, performance assessment is mandated by the Board of Education. Teachers should ask themselves, “What achievement has the student demonstrated in this work? What is the level of accomplishment? What contributes to the quality?” (Mabry, 1999). By doing so, teachers are setting goals for themselves to achieve with their students. Moreover, ipsative assessment involves predicting students’ performances based on students’ skills and knowledge, strength and weaknesses, opportunity to learn goals, motivation, and interests. Ipsative assessment focuses on each student individually and how that student performs and what he/she accomplishes. Each student has his/her own way of learning and performing. Students need to interact with other students in the classroom and work with other students in groups to pick up his/her own way of learning.

**Summary**

In conclusion, the previously stated research supports this researcher’s hypothesis that math, science, and technology education theories contribute to students’ achievements in the classroom. This, in turn can eventually raise a student’s test scores.
Also, there are several reputable publications that support the notion that MST theories can and do work. Unfortunately, not nearly enough research has been done on MST to verify the hypotheses. Therefore, I am conducting my research in order to verify and shed some light on the integration of math, science, and technology education, its effects, and outcomes.
CHAPTER 3
METHODOLOGY

Design of the Research

The static group comparison was used.

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1999 by the Ohio Board of Education. The results were available for the researcher on January 16, 2000 in order to perform the analysis. Also, the researcher looked at the 1997-1998 and 1998-1999 standardized proficiency test scores from the same group of students when they were in the ninth and tenth grades. The purpose of reviewing the proficiency tests was to compare the control to the treatment group. Also, the researcher looked at the record of eleventh grade students from when they were in the ninth and tenth grades to determine when they passed the standardized proficiency test. The purpose of this screening was to evaluate if students who were in the integrated program passed the standardized proficiency test sooner and with higher scores than those students who were not in the integrated program. A technology education instructor provided the list of students who were in the integrated program.

Validity

Validity is defined as, “The appropriateness, meaningfulness, and usefulness of the specific inferences made from the test score” (Litwin, 1995, p.5). To insure validity for the proficiency test, content committees were formed and were charged for ensuring the curricular and content validity. The 9th grade proficiency test was validated by the Ohio department of Education. In order to insure curricular validity, the content committee was asked by the Ohio Department of Education to consider the state’s model curriculum guides, sample of graded courses of study from Ohio school districts, standards adopted by national learned societies, and lists of competencies adopted by other states. For content validity, the Ohio Department of Education asked the content committee to judge whether the task was an appropriate measure of students’
competencies for the intended grade. By doing so, the committee had an idea of the level of preparation students would have prior to completing the proficiency test. Also, the committee was asked to evaluate the appropriateness and fairness of the tasks that were reviewed. Moreover, the committee judged the items designed for the field test. Following the field test, the committee reviewed the data from the test to ensure the appropriateness and fairness of the items. (Ohio Department of Education, 2000)

**Reliability**

Reliability means that the instrument was consistent in what it measures. For the reliability of the proficiency test, the Ohio Department of Education used the KR-20 (Kuder-Richardson 20) index. The KR-20 was used when items were or added together to represent one variable. Also, it was used when responses to items were dichotomous, e.g., yes/no questions, or multiple-choice items with one correct response. The KR-20 reliability index provided information on the internal consistency of the test. The reliability index should, in most cases be above .85, but the estimate was very dependent upon the variability of the students taking the test, but with a homogeneous group of students the reliability should be around .80 (Ohio Department of Education, 2000).

The standardized proficiency test carried demographic information about the students (gender and ethnicity). Moreover, the researcher compared the standardized proficiency test results from students who were in the integrated program to those who were not in the integrated program, keeping in mind students’ gender and ethnicity.
Data Collection and Analysis

Student names and identities were kept anonymous. A technology teacher from a large Ohio suburban High School and a person from the School District were in charge of handling and assigning codes to the data. Afterwards, the researcher received the anonymous data in order to perform the analysis. For all of the hypotheses (1.1, 1.2, 1.3, 2.1, 2.2, 3.1, 3.2, 3.3, 3.4, 3.5):

The means and standard deviations were used to report the results of the descriptive statistics of these hypotheses. Since the researcher assumed that the students in this study are representative of a larger population, t-tests were conducted in order to show that the results did not happen due to chance. The alpha level the researcher used was 0.05, which meant that the researcher wanted to be 95% confident. If the probability associated with the calculated “t” was equal to or less than alpha, the null hypothesis was rejected, but if the probability associated with the calculated “t” was greater than alpha, the null hypothesis would not be rejected.

Population

The target population was all eleventh grade students at a large Ohio suburban high school. The researcher looked at the eleventh grade students math and science proficiency test results from when they were in the ninth grade (97-98), and the tenth grade (98-99), and the eleventh grade (Autumn 1999 only). The students were divided into two groups. The treatment group consisted of the students in the integrated math, science, and technology education program. The control group consisted of the students in the non-integrated math, science, and technology education program. A technology
education instructor provided the list of the students who were in the integrated math, science, and technology education program during the ninth, tenth, and eleventh grades. The technology teacher and the School District provided the list of students who were not in the integrated program in the ninth, tenth, and eleventh grades. Table 3.1 summarizes the distribution of students in the study and the average GPA of each group.

### Students at The High School

<table>
<thead>
<tr>
<th></th>
<th>Number of students</th>
<th>GPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Over all students</td>
<td>310</td>
<td>2.54</td>
</tr>
<tr>
<td>Excluded students</td>
<td></td>
<td></td>
</tr>
<tr>
<td>poor attendance, expelled, developmentally disabled, and suspended students</td>
<td>31</td>
<td></td>
</tr>
<tr>
<td>Students in the study</td>
<td>279</td>
<td></td>
</tr>
<tr>
<td>Non integrated students</td>
<td>221</td>
<td>2.63</td>
</tr>
<tr>
<td>Integrated students</td>
<td></td>
<td></td>
</tr>
<tr>
<td>One integrated course</td>
<td>58</td>
<td>2.2</td>
</tr>
<tr>
<td>Two or more integrated courses</td>
<td>50</td>
<td>2.15</td>
</tr>
</tbody>
</table>

Table 3.1: The distribution of students in the study and the average GPA of each group.

The research started with three 310 students in the eleventh grade. Sixty-eight students were in the integrated math, science, and technology education program, and
242 students were in the non-integrated math, science, and technology education program. The study was limited to those students who were enrolled in January of 2000, who attended classes regularly and were not exempt from taking the proficiency test as reported by the technology instructor and the school district. Thus, students with poor attendance, expelled students, developmentally disabled students, and suspended students were excluded. In the end, the final count of students was 58 students in the integrated math, science, and technology education program and 221 students in the non-integrated math, science, and technology education program. Of the 58 students in the integrated program, 8 had taken only one integrated course and 50 had taken two or more integrated courses.
CHAPTER 4

ANALYSIS OF THE DATA

Introduction

The primary purpose of this study was to investigate the influence of the integrated math, science, and technology education program on students' performances on the State of Ohio 9th grade proficiency test. A total of 279 students were included in this study. Fifty-eight students were in the integrated program of math, science, and technology. Two hundred twenty one students were in the non-integrated math, science, and technology program.

The means and standard deviations were used to report the results of the descriptive statistics of this study. On the other hand, since the researcher assumed that the students in this study could be representatives of a larger population, t-tests were conducted in order to show that the results did not happen due to chance.

The following research questions were formulated for this study:

1- Does the integration of math, science, and technology education in a selected Tech-prep program have an effect on the math and science sub-sections of the Ohio standardized proficiency test?
Does the integration of math, science, and technology education affect the math and science sub-sections scores of the Ohio proficiency test based on gender? 

Does the integration of math, science, and technology education affect the math and science sub-sections scores of the Ohio proficiency test based on ethnicity or race? 

Also, hypotheses were formulated to thoroughly investigate the research questions.

1.1- Students who had one course of the integrated math, science, and technology education program will have higher math and science sub-sections of the Ohio standardized proficiency test scores than those students who did not have any integrated program.

1.2- Students who had two or more courses of the integrated math, science, and technology education program will have higher math and science sub-sections of the Ohio standardized proficiency test scores than those students who did not have any integrated program.

1.3- Students who had two or more courses of the integrated math, science, and technology education program will have higher math and science sub-sections of the Ohio standardized proficiency test scores than those students who had one integrated course.

2.1- Female students who are in the math, science, and technology education
integrated program will have higher math and science sub-sections of the Ohio standardized proficiency test scores than those female students who are not in the integrated program.

2.2- Male students who are in the math, science, and technology education integrated program will have higher math and science sub-sections of the Ohio standardized proficiency test scores than those male students who are not in the integrated program.

3.1- African-American students who are in the math, science, and technology education integrated program will have higher math and science sub-sections of the Ohio standardized proficiency test scores than African-American students who are not in the integrated program.

3.2- Caucasian students who are in the math, science, and technology education integrated program will have higher math and science sub-sections of the Ohio standardized proficiency test scores than Caucasian students who are not in the integrated program.

3.3- Hispanic students who are in the math, science, and technology education integrated program will have higher math and science sub-sections of the Ohio standardized proficiency test scores than Hispanic students who are not in the integrated program.

3.4- Asian students who are in the math, science, and technology education integrated program will have higher math and science sub-sections of the Ohio standardized proficiency test scores, than Asian students who are not in the integrated program.
3.5- American-Indian students who are in the math, science, and technology education integrated program will have higher math and science sub-sections of the Ohio standardized proficiency test scores, than American-Indian students who are not in the integrated program.

**Discussion and Findings**

Looking at question #1 and hypotheses 1.1:

1- Does the integration of math, science, and technology education in a selected Tech-prep program have an effect on the math and science sub-sections of the Ohio standardized proficiency test?

1.1- Students who had one course of the integrated math, science, and technology education program will have higher math and science sub-sections of the Ohio standardized proficiency test scores than those students who did not have any integrated program.

In order to answer question #1 and hypotheses #1.1, the researcher divided the answers into math and science sections. First, the researcher focused upon the math data analysis, concerning the integrated and the non-integrated groups. Second, the researcher performed the science data analysis, regarding the integrated and the non-integrated groups.

There were 8 students in the integrated program who had one integrated course. Three of those 8 students passed the math portion of the proficiency test in 1997 and, therefore their scores are not available. This left 5 students for the data analysis. Students who had
taken any integrated classes numbered 221, of which 125 passed the math portion of the proficiency test in 1997, and therefore their scores are not available. This left 96 students for the data analysis.

As shown in Table 4.1, the mean math scores for students who had one integrated math, science, and technology education program was 202, and 200.55 for the students who did not have any integrated programs. This showed there was a slight difference between the means of the two groups. The standard deviations were used to show variability in the math scores between the two groups. The standard deviations for the integrated math, science, and technology education program were 2.35, and 10.87 for the non-integrated program, which showed different variability in the math scores between the two groups.

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>One Integrated Course</td>
<td>5</td>
<td>202.00</td>
<td>2.35</td>
<td>1.05</td>
</tr>
<tr>
<td>Non-Integrated</td>
<td>96</td>
<td>200.55</td>
<td>10.87</td>
<td>1.11</td>
</tr>
</tbody>
</table>

Table 4.1: The mean math scores, and standard deviations for students who had one integrated math, science, and technology program and students who did not have any integrated programs.

The means and standard deviations were used to report the results of the descriptive statistics of this study. On the other hand, since the researcher assumed that the students in this study could be representatives of a larger population; t-tests were
conducted in order to show that the results did not happen due to chance.

**Decision Rule**

The t-test for samples of unequal variances was used, even though Levene's test for equality of variance showed equal variances, since the samples were of unequal size and had a large difference in their standard deviations. Since the hypothesis is a directional hypothesis, a one-tail t-test was needed in order to analyze the data. If the probability associated with the calculated “t” is equal to or less than alpha the null hypothesis was rejected, but if the probability associated with the calculated “t” was greater than alpha the null hypothesis would not be rejected and the means of the two groups do not differ significantly. Table 4.2 showed that the significance value of the one-tail t-test was 0.178. Given that the significance level of calculated “t” was 0.178, which was greater than the alpha level of .05 the null hypothesis failed to be rejected, which meant that the students who had one course of the integrated math, science, and technology education program did not differ significantly in their standardized proficiency math scores, from the students who did not have any sort of integration. Also, as shown by the standard error of the difference of the mean of 4.89 and 1.53, the difference could have been due to sampling error.
<table>
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<tr>
<td>Equal variances not assumed</td>
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<td>17.055</td>
</tr>
</tbody>
</table>

Table 4.2: The independent sample test of math for students who had one integrated program and students who did not have any integrated program.

Figure 1 shows the distribution of the math scores among students who had one course of the integrated math, science, and technology education program and the students who did not have any integration. The math scores of the students who had one integrated math, science, and technology education program tended to be closer to the passing score of 200, while the distribution of the math scores for students who did not have any integration tended to be spread all over the chart, which indicated that the students who had one integrated math, science, and technology education program had a greater tendency to pass the math section of the standardized proficiency test than students in the non-integrated program.
**Note.** 38% (N=3) of students who had one integrated course and 57% (N=125) of students who did not have an integrated course did not have math scores and are not shown in Figure 1.

**Figure 1:** The distribution of the math scores among students who had one course of the integrated math, science, and technology program (N=5) and the students who did not have any integration (N=96).
Figure 2 shows the distribution of the number of math attempts among students who had one course of the integrated math, science, and technology education program and the students who did not have any integration. Students who had one integrated math, science, and technology education program tended to need fewer attempts to pass the math test than students who did not have any integration. This indicated that the students who had one integrated math, science, and technology education program had a greater tendency to pass the standardized proficiency sooner than students in the non-integrated program.

Figure 2: The distribution of the number of math attempts among students that had one course of the integrated math, science, and technology program (N=8) and the students who did not have any integration (N=221).
The mean science scores for students who had one integrated math, science, and technology education program shown in Table 4.3, was 204.50, and 199.18 for the students who did not have any integrated program. This showed there was a slight difference between the means of the two groups. The standard deviations were used to show variability in the math scores between the two groups. The standard deviations for the integrated math, science, and technology education program were 8.35, and 11.13 for the non-integrated program.

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
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</thead>
<tbody>
<tr>
<td>One Integrated Course</td>
<td>4</td>
<td>204.50</td>
<td>8.35</td>
<td>4.17</td>
</tr>
<tr>
<td>Non-Integrated</td>
<td>82</td>
<td>199.18</td>
<td>11.14</td>
<td>1.23</td>
</tr>
</tbody>
</table>

Table 4.3: The mean science scores, and standard deviations for students who had one integrated math, science, and technology program and students who did not have any integrated programs.

The t-test for samples of unequal variances was used, even though Levene’s test for equality of variance showed equal variances, since the samples were of unequal size and had a difference in their standard deviations. Table 4.4 showed that the significance value of the one-tail t-test was 0.15. Given that the significance level of calculated “t” was .15, which was greater than the alpha level of .05, the null hypothesis failed to be rejected, meaning that the students who had one course of the integrated math, science, and technology program did not differ significantly in their standardized
proficiency science scores from the students who did not have any sort of integration.

Also, as shown by the standard error of the difference of the mean of 5.66 and 4.35 the difference could have been due to sampling error.

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<tr>
<td>Equal variances not assumed</td>
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</table>

Table 4.4: The independent sample test of science scores for students who had one integrated program and students who did not have any integrated program.

Figure 3 shows the distribution of the science scores among students who had one course of the integrated math, science, and technology education program and the students who did not have any integration. The science scores of the students who had one integrated math, science, and technology education program tended to be closer to the passing score of 200, while the distribution of the science scores for students who did not have any integration tend to be spread all over the chart, which indicated that the students who had one integrated math, science, and technology education program had a
greater tendency to pass the science section of the standardized proficiency test, than students in the non-integrated program.

Note. 50% (N=4) of students who had one integrated course and 63% (N=139) of students who did not have an integrated course did not have math scores and are not shown in Figure 3.

Figure 3: The distribution of the science scores among students who had one course of the integrated math, science, and technology program (N=4) and the students who did not have any integration (N=82).
Figure 4 shows the distribution of the science attempts among students who had one integrated math, science, and technology education program and the students who did not have any integration. Students who had one integrated math, science, and technology education program tended to have a similar number of attempts to pass the science test compared to the students who did not have any integration program.

Figure 4: The distribution of the number of science attempts among students who had one course of the integrated math, science, and technology education program (N=8) and the students who did not have any integration (N=221).
1.2- Students who had two or more courses of the integrated math, science, and technology education program will have higher math and science sub-sections of the Ohio standardized proficiency test scores than those students who did not have any integrated program.

By looking at Table 4.5, the mean math scores for students who had two integrated math, science, and technology education programs was 202.85 and 200.55 for the students who did not have any integrated programs. This showed there was a slight difference between the means of the two groups. The standard deviations were used to show variability in the math score between the two groups. The standard deviations for the integrated math, science, and technology education program were 5.20, and 10.87 for the non-integrated program, which showed different variability between the math scores between the two groups.

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two or more</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Integrated courses</td>
<td>33</td>
<td>202.85</td>
<td>5.20</td>
<td>0.91</td>
</tr>
<tr>
<td>Non-Integrated</td>
<td>96</td>
<td>200.55</td>
<td>10.87</td>
<td>1.11</td>
</tr>
</tbody>
</table>

Table 4.5: The mean scores of math, and standard deviations for students who had two or more integrated math, science, and technology programs and students who did not have any integrated programs.
The means and standard deviations were used to report the results of the descriptive statistics of this study. On the other hand, since the researcher assumed that the students in this study could be representatives of a larger population; t-tests were conducted in order to show that the results did not happen due to chance.

**Decision Rule**

The t-test for samples of unequal variances was used, even though Levene’s test for equality of variance showed equal variances, since the samples were of unequal size and had a large difference in their standard deviations. Since the hypothesis is a directional hypothesis, a one-tail t-test was needed in order to analyze the data. If the probability associated with the calculated “t” is equal to or less than alpha, the null hypothesis was rejected, but if the probability associated with the calculated “t” was greater than alpha the null hypothesis would not be rejected and the means of the two groups would not differ significantly. Table 4.6 showed that the significance value of the one-tail t-test was 0.06. Given that the significance level of calculated “t” was 0.06, which was greater than the alpha level of .05, the null hypothesis failed to be rejected, which meant that the students who had one course of the integrated math, science, and technology education program did not differ significantly in their standardized. Even though there was a slight difference in the mean scores in math between the two groups of students, it was not a substantial difference. Also, as shown by the standard error of the difference of the mean of 1.97 and 1.43, the difference could have been due to sampling error.
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<tr>
<td>Equal variances not assumed</td>
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</table>

Table 4.6: The independent sample test of math for students who had two integrated programs and students who did not have any integrated program.

Figure 5 shows the distribution of the math scores among students who had two or more course of the integrated math, science, and technology education program and the students who did not have any integration. The math scores of the students who had one integrated math, science, and technology education program tended to be closer to the passing score of 200, while the distribution of the math scores for students who did not have any integration tend to be spread all over the chart, which indicated that the students who had two or more courses in the integrated math, science, and technology program had a greater tendency to pass the math section of the standardized proficiency test than students in the non-integrated program.
Note. 38% (N=13) of students who had two integrated course and 57% (N=125) of students who did not have an integrated course did not have math scores and are not shown in Figure 5.

Figure 5: The distribution of the math scores among students who had two courses of the integrated math, science, and technology program (N=33) and the students who did not have any integration (N=96).
Figure 6 shows the distribution of the number of math attempts among students who had two or more courses of the integrated math, science, and technology education program and the students who did not have any integration. Students who had two or more courses in the integrated math, science, and technology education program tended to need fewer attempts to pass the math test, than students who did not have any integration. This indicated that the students who had one integrated math, science, and technology education program had a greater tendency to pass the standardized proficiency sooner, than students in the non-integrated program.

![Figure 6: The distribution of the number of math attempts among students that had two courses of the integrated math, science, and technology program (N=50) and the students who did not have any integration (N=221).](image)

By looking at Table 4.7, the mean science scores for students who had two courses in the integrated math, science, and technology education programs was 204.67, and 199.18 for the students who did not have any integrated programs. This showed there was a slight difference between the means of the two groups. The standard deviations were used to show variability in the math scores between the two groups. The standard deviations for the integrated math, science, and technology education program were 11.00, and 11.14 for the non-integrated program, which showed different variability between the math scores between the two groups.

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two or more integrated courses</td>
<td>24</td>
<td>204.67</td>
<td>11.00</td>
<td>2.25</td>
</tr>
<tr>
<td>Non-Integrated</td>
<td>82</td>
<td>199.18</td>
<td>11.14</td>
<td>1.23</td>
</tr>
</tbody>
</table>

Table 4.7: The mean scores of science, and standard deviations for students who had two or more integrated math, science, and technology program and students who did not have any integrated programs.

Table 4.8 showed that the significant value of the one-tail t-test was 0.019. Given that the significance level of calculated “t” was .019, which was less than the alpha level of .05 the null hypothesis was rejected, which meant that the students who had two or more courses of the integrated math, science, and technology education program
would have higher standardized proficiency science scores compared to the students who did not have any sort of integration.

<table>
<thead>
<tr>
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<td>0.425</td>
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<tr>
<td>Equal variances not assumed</td>
<td>2.141</td>
<td>37.895</td>
</tr>
</tbody>
</table>

Table 4.8: The independent sample test of science for students who had two integrated programs and students who did not have any integrated program.

Figure 7 shows the distribution of the science scores among students who had two or more courses of the integrated math, science, and technology education program and the students who did not have any integration. The science scores of the students who had two or more courses in the integrated math, science, and technology education program tend to be closer to the passing score of 200, while the distribution of the science scores for students who did not have any integration tend to be spread all over the chart, which indicated that the students who had one integrated math, science, and technology education program.
had a greater tendency to pass the science section of the standardized proficiency test, than students in the non-integrated program.

Note. 52% (N=26) of students who had two or more integrated course and 63% (N=139) of students who did not have an integrated course did not have science scores and are not shown in Figure 7.

Figure 7: The distribution of the science scores among students who had two courses of the integrated math, science, and technology program (N=24) and the students who did not have any integration (N=82).
Figure 8 shows the distribution of the science attempts among students that had two or more courses in the integrated math, science, and technology education program and the students who did not have any integration. Students who had two or more courses in the integrated math, science, and technology education program tended to have a similar number of attempts to pass the science test compared to the students who did not have any integration.

![Bar chart showing distribution of science attempts](image)

**Figure 8:** The distribution of the number of science attempts among students who had two courses of the integrated math, science, and technology program (N=50) and the students who did not have any integration (N=221).
1.3- Students who had two or more courses of the integrated math, science, and technology education program will have higher math and science sub-sections of the Ohio standardized proficiency test scores, than those students who had one integrated course.

As shown in Table 4.9, the mean math scores for students who had two courses in the integrated math, science, and technology education programs was 202.85, and 202.00 for the students who had one course in the integrated program. This showed there was no difference between the means of the two groups. The standard deviations were used to show variability in the math scores between the two groups. The standard deviations of math scores for students who had two courses of the integrated math, science, and technology education program was 5.20, and 2.35 for the students who had one course of the integrated math, science, and technology education program, which showed a difference in variability between the math scores between the two groups.

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
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</thead>
<tbody>
<tr>
<td>Two or more Integrated Courses</td>
<td>33</td>
<td>202.85</td>
<td>5.20</td>
<td>0.91</td>
</tr>
<tr>
<td>One Integrated Course</td>
<td>5</td>
<td>202.00</td>
<td>2.35</td>
<td>1.05</td>
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</tbody>
</table>

Table 4.9: The mean math scores, and standard deviations for students who had two or more integrated programs and students who had one integrated math, science, and technology education program.
The means and standard deviations were used to report the results of the descriptive statistics of this study. On the other hand, since the researcher assumed that the students in this study could be representatives of a larger population, t-tests were conducted in order to show that the results did not happen due to chance.

**Decision Rule**

The t-test for samples of unequal variances was used, even though Levene’s test for equality of variance showed equal variances, since the samples were of unequal size and had a large difference in their standard deviations. Since the hypothesis is a directional hypothesis, a one-tail t-test was needed in order to analyze the data. If the probability associated with the calculated “t” was equal to or less than alpha, the null hypothesis was rejected, but if the probability associated with the calculated “t” was greater than alpha the null hypothesis would not be rejected demonstrating that the means of the two groups do not differ significantly. Table 4.10 showed that the significance value of the one-tail t-test was 0.276. Given that the significance level of calculated “t” was of 0.276, which was greater than the alpha level of .05, the null hypothesis failed to be rejected, which meant that the students who had two or more courses of the integrated math, science, and technology education program did not differ significantly in their standardized proficiency math scores from the students who had one integrated course. Even though there was a slight difference in the mean scores of math between the two groups of students, it was not a substantial difference. Also, as shown by the standard error of the difference of the mean of 2.38 and 1.39, the difference could have been due
to sampling error.

<table>
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<tr>
<td>Equal variances not assumed</td>
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<td>0.612</td>
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</table>

Table 4.10: The independent sample test of math for students who had two integrated programs and students who had one integrated program.

Figure 9 shows the distribution of the math scores among students who had two courses of the integrated math, science, and technology education program and the students who had one course of the integrated math, science, and technology education program. The math scores of the students who had one integrated course of math, science, and technology education program tended to be closer to the passing score of 200, while the distribution of the math scores for students who had two or more courses of integration tend to be spread all over the chart.
Note. 38% (N=3) of students who had one integrated course and 34% (N=13) of students who had two or more integrated courses did not have math score and are not shown in Figure 9.

Figure 9: The distribution of the math scores among students who had two courses of the integrated math, science, and technology program (N=33) and the students who had one course of the integrated math, science, and technology program (N=5).
Figure 10 shows the distribution of the number of math attempts among students who had two or more courses of the integrated math, science, and technology education program and the students who had one integrated course. Students who had one integrated math, science, and technology education program tended to need fewer attempts to pass the math test than students who had two or more integrated courses.

Figure 10: The distribution of the number of math attempts between students who had two courses of the integrated math, science, and technology education program (N=50) and the students who had one course of the integrated math, science, and technology education program (N=8).
By looking at Table 4.11, the mean science scores for students who had two courses in the integrated math, science, and technology education program was 204.67, and 204.50 for the students who had one integrated program. This showed there was no difference between the means of the two groups. The standard deviations were used to show variability in the math scores between the two groups. The standard deviations of math scores for students who had two courses of the integrated math, science, and technology education program was 11.00, and 8.35 for the students who had one course of the integrated math, science, and technology program, which showed different variability between the math scores between the two groups.

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two or more Integrated Courses</td>
<td>24</td>
<td>204.67</td>
<td>11.00</td>
<td>2.25</td>
</tr>
<tr>
<td>One Integrated Course</td>
<td>4</td>
<td>204.50</td>
<td>8.35</td>
<td>4.17</td>
</tr>
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</table>

Table 4.11: The mean science scores, and standard deviations for students who had two or more integrated programs and students who had one integrated math, science, and technology education program.
The means and standard deviations were used to report the results of the descriptive statistics of this study. On the other hand, since the researcher assumed that the students in this study could be representatives of a larger population; t-tests were conducted in order to show that the results did not happen due to chance.

Decision Rule

The t-test for samples of unequal variances was used, even though Levene’s test for equality of variance showed equal variances, since the samples were of unequal size and had a large difference in their standard deviations. Since the hypothesis is a directional hypothesis, a one-tail t-test was needed in order to analyze the data. If the probability associated with the calculated “t” was equal to or less than alpha the null, hypothesis was rejected, but if the probability associated with the calculated “t” was greater than alpha the null hypothesis would not be rejected and the means of the two groups show no significant difference. Table 4.12 showed that the significance value of the one-tail t-test was 0.486. Given that the significance level of calculated “t” was of 0.486, which was greater than the alpha level of .05 the null hypothesis failed to be rejected, which meant that the students who had two courses of the integrated math, science, and technology education program did not differ in their standardized proficiency science scores test, than the students who had one course of the integrated program. Also, as shown by the standard error of the difference of the mean of 5.80 and 4.74 the difference could have been due to sampling error.
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</thead>
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<td>sig.</td>
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<td>1.000</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
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<td>0.035</td>
</tr>
</tbody>
</table>

Table 4.12: The independent sample test of science for students who had two integrated programs and students who had one integrated program.
Figure 11 shows the distribution of the science scores among students who had two courses of the integrated math, science, and technology program and the students who had one course of the integrated math, science, and technology program.

![Graph showing distribution of science scores](image)

**Note.** 50% (N=4) of students who had one integrated course and 52% (N=26) of students had two or more integrated course did not have science score and are not shown in Figure 11.

Figure 11: The distribution of the science scores among students who had two courses of the integrated math, science, and technology education program (N=24) and the students who had one course of the integrated math, science, and technology education program (N=4).
Figure 12 shows the distribution of the number of science attempts between students who had two courses of the integrated math, science, and technology education program and the students who had one course of the integrated math, science, and technology program. Students who had one integrated math, science, and technology education program tended to have a similar number of attempts to pass the science test compared to the students who had two or more integrated courses.

Figure 12: The distribution of the number of science attempts between students that had two courses of the integrated math, science, and technology education program (N=50) and the students who had one course of the integrated math, science, and technology education program (N=8).
Looking at question #2 and hypotheses 2.1:

2- Does the integration of math, science, and technology education affect the math and science sub-sections scores of the Ohio proficiency test based on gender?

2.1- Female students who are in the math, science, and technology education integrated program will have higher math and science sub-sections of the Ohio standardized proficiency test scores than those female students who are not in the integrated program.

As shown in Table 4.13, the mean math scores for female students who had the integrated math, science, and technology education program was 201.93, and 200.43 for female students who did not have the integrated program. This showed there is no difference between the means of the two groups. The standard deviations were used to show variability in the math scores between the two groups. The standard deviations of the math scores for female students who had the integrated math, science, and technology education program was 4.48, and 9.68 for female students who did not have the integrated math, science, and technology education program, which showed different variability between the math scores between the two groups.
<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integrated</td>
<td>14</td>
<td>201.93</td>
<td>4.48</td>
<td>1.20</td>
</tr>
<tr>
<td>Non-Integrated</td>
<td>54</td>
<td>200.43</td>
<td>9.68</td>
<td>1.32</td>
</tr>
</tbody>
</table>

Table 4.13: The mean math scores, and standard deviations for female students who had one or two integrated programs and female students who did not have any integrated programs.

The means and standard deviations were used to report the results of the descriptive statistics of this study. On the other hand, since the researcher assumed that the students in this study could be representatives of a larger population, t-tests were conducted in order to show that the results did not happen due to chance.

**Decision Rule**

The t-test for samples of unequal variances was used, even though Levene’s test for equality of variance showed equal variances, since the samples were of unequal size and had a large difference in their standard deviations. Since the hypothesis is a directional hypothesis, a one-tail t-test was needed in order to analyze the data. If the probability associated with the calculated "t" was equal to or less than alpha the null hypothesis was rejected, but if the probability associated with the calculated "t" was greater than alpha the null hypothesis would not be rejected and the means of the two groups do not differ significantly. Table 4.14 showed that the significance value of the one-tail t-test was 0.201. Given that the significance level of calculated "t" was 0.201,
which was greater than the alpha level of .05, the null hypothesis failed to be rejected, which meant that the female students who were enrolled in the integrated math, science, and technology education program did not differ in their standardized proficiency math, scores, from the students who were not enrolled in the integrated math, science, and technology program. Also, as shown by the standard error of the difference of the means of 2.67 and 1.78, the difference could have been due to sampling error.

<table>
<thead>
<tr>
<th></th>
<th>Levene's Test for Equality</th>
<th>t-test for Equality of means</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>sig.</td>
</tr>
<tr>
<td>Equal variances assumed</td>
<td>5.586</td>
<td>0.021</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td>0.844</td>
<td>46.750</td>
</tr>
</tbody>
</table>

Table 4.14: The independent sample test of math for female students who had one or more integrated programs and female students who did not have any integrated programs.

Figure 13 shows the distribution of the math scores among female students who had the integrated math, science, and technology education program and female students who did not have any integrated math, science, and technology education program. The math scores for female students who had the integrated math, science, and technology
education program tend to be closer to the passing score of 200, while the distribution of
the math scores for female students who did not have any integration tended to be spread
all over the chart. This indicated that the female students who had the integrated math,
science, and technology education program had a greater tendency to pass the math
section of the standardized proficiency test than students in the non-integrated program.

![Math Scores Chart]

**Note.** 35% (N=20) of female students who had the integrated program and 57% (N=125)
of female students who did not have an integrated course did not have math score and are
not shown in Figure 13.

**Figure 13:** The distribution of the math scores among female students who had the
integrated math, science, and technology education program (N=38) and female students
who did not have any integrated math, science, and technology education program
(N=96).
Figure 14 show the number of math attempts among female students who had the integrated math, science, and technology program and female students who did not have any integrated math, science, and technology program.

![Bar chart showing the number of math attempts](chart.png)

**GROUP2**
- Integrated
- NonIntegrated

**Math attempts**

Figure 14: The number of math attempts among female students who had the integrated math, science, and technology education program (N=58) and female students who did not have any integrated math, science, and technology education program (N=221).
By looking at Table 4.15, the mean science scores for female students who had the integrated math, science, and technology education program was 203.46, and 198.60 for female students who did not have the integrated program. This shows there was a slight difference between the means of the two groups, but not a significant difference. The standard deviations were used to show variability in the science scores between the two groups. The standard deviations of science scores for female students who had the integrated math, science, and technology education program was 10.40, and 10.85 for female students who did not have the integrated math, science, and technology education program, which showed different variability between the science scores between the two groups.

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integrated</td>
<td>13</td>
<td>203.46</td>
<td>10.40</td>
<td>2.88</td>
</tr>
<tr>
<td>Non-Integrated</td>
<td>45</td>
<td>198.60</td>
<td>10.85</td>
<td>1.62</td>
</tr>
</tbody>
</table>

Table 4.15: The mean scores of math and standard deviations for female Students who had one or two integrated programs and female Students who did not have any integrated programs.
The means and standard deviations were used to report the results of the descriptive statistics of this study. On the other hand, since the researcher assumed that the students in this study could be representatives of a larger population, t-tests were conducted in order to show that the results did not happen due to chance.

**Decision Rule**

The t-test for samples of unequal variances was used, even though Levene’s test for equality of variance showed equal variances, since the samples were of unequal size and had a large difference in their standard deviations. Since the hypothesis is a directional hypothesis, a one-tail t-test was needed in order to analyze the data. If the probability associated with the calculated “t” was equal to or less than alpha the null, the hypothesis was rejected, but if the probability associated with the calculated “t” was greater than alpha the null hypothesis would not be rejected and the means of the two groups do not differ significantly. Table 4.16 showed that the significance value of the one-tail t-test was 0.070. Given that the significance level of calculated “t” was 0.07, which was greater than the alpha level of .05 the null hypothesis failed to be rejected, which meant that the female students who were enrolled in the integrated math, science, and technology education program did not differ in their standardized proficiency science scores, than those students who were not enrolled in the integrated math, science, and technology education program. Even though there was a slight difference in the mean scores of math between the two groups of students, it was not a substantial difference. Also, as shown by the standard error of the difference of the means of 3.39 and 3.31 the difference could have been due to sampling error.
Table 4.16: The independent sample test of science for female students who had one or more integrated programs and female students who did not have any integrated programs.

<table>
<thead>
<tr>
<th>Levene’s Test for Equality</th>
<th>t-test for Equality of means</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
</tr>
<tr>
<td>Equal variances assumed</td>
<td>0.048</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td></td>
</tr>
</tbody>
</table>

Figure 15 shows the distribution of the science scores among female students who had the integrated math, science, and technology education program and female students who did not have any integrated math, science, and technology education program. The science scores of the female students who had the integrated math, science, and technology program tend to be closer to the passing score of 200, while the distribution of the science scores for female students who did not have any integration tend to be spread all over the chart, which indicated that female students who had one integrated math, science, and technology program had a greater tendency to pass the science section of the standardized proficiency test, than female students in the non-integrated program.
Note. 52% (N=30) of female students who had the integrated course and 63% (N=139) of female students who did not have an integrated course did not have science score and are not shown in Figure 15.

Figure 15: The distribution of the science scores among female students who had the integrated math, science, and technology education program (N=28) and female students who did not have any integrated math, science, and technology education program (N=82).
Figure 16 show the number of science attempts among female students who had the integrated math, science, and technology education program and female students who did not have any integrated math, science, and technology education program. Female Students who had the integrated math, science, and technology education program tended to have a similar number of attempts to pass the science test, to female students who did not have any integration.

![Graph showing science attempts](image)

*Figure 16: The number of science attempts among female students who had the integrated math, science, and technology education program (N=58) and female students who did not have any integrated math, science, and technology education program (N=221).*
2.2- Male students who are in the math, science, and technology integrated program will have higher standardized proficiency test scores than those Male students who are not in the integrated program.

As shown in Table 4.17, the mean math scores for male students who had the integrated math, science, and technology education program was 203.21, and 200.71 for male students who did not have the integrated program. This showed there was a slight difference between the means of the two groups, but not a significant difference. The standard deviations were used to show variability in the math scores between the two groups. The standard deviations of the math scores for male students who had the integrated math, science, and technology program was 5.18, and 12.35 for male students who did not have the integrated math, science, and technology education program, which showed different variability between the math scores between the two groups.

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integrated</td>
<td>24</td>
<td>203.21</td>
<td>5.18</td>
<td>1.06</td>
</tr>
<tr>
<td>Non-Integrated</td>
<td>42</td>
<td>200.71</td>
<td>12.35</td>
<td>1.90</td>
</tr>
</tbody>
</table>

Table 4.17: The mean math scores and standard deviations for male students who had one or two integrated programs and male students who did not have any integrated programs.
The means and standard deviations were used to report the results of the descriptive statistics of this study. On the other hand, since the researcher assumed that the students in this study could be representatives of a larger population, t-tests were conducted in order to show that the results did not happen due to chance.

**Decision Rule**

The t-test for samples of unequal variances was used, even though Levene's test for equality of variance showed equal variances, since the samples were of unequal size and had a large difference in their standard deviations. Since the hypothesis is a directional hypothesis, a one-tail t-test was needed in order to analyze the data. If the probability associated with the calculated “t” was equal to or less than alpha, the null hypothesis was rejected, but if the probability associated with the calculated “t” was greater than alpha the null hypothesis would not be rejected and the means of the two groups do not differ significantly. Table 4.18 showed that the significance value of the one-tail t-test was 0.128. Given that the significance level of calculated “t” was 0.128, which was greater than the alpha level of .05, the null hypothesis failed to be rejected, which meant that the male students who were enrolled in the integrated math, science, and technology education program did not differ in their standardized proficiency math scores, from those students who were not enrolled in the integrated math, science, and technology education program. Even though there was a slight difference in the mean scores of math between the two groups of students, it was not a substantial difference. Also, as shown by the standard error of the difference of the means of the two groups 2.65 and 2.18 the difference could have been due to sampling error.
<table>
<thead>
<tr>
<th></th>
<th>Levene's Test for Equality</th>
<th>t-test for Equality of means</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>sig.</td>
</tr>
<tr>
<td>Equal variances assumed</td>
<td>10.057</td>
<td>0.002</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td>1.145</td>
<td>59.982</td>
</tr>
</tbody>
</table>

Table 4.18: The independent sample test of math for male students who had one or more integrated programs and male students who did not have any integrated programs.

Figure 17 shows the distribution of the math scores among male students who had the integrated math, science, and technology education program and male students who did not have any integrated math, science, and technology education program. The math scores of male students who had the integrated math, science, and technology education program tend to be clustered around the passing score of 200, while the distribution of the math scores for male students who did not have any integration tend to be spread all over the chart, which indicated that the male students who had one integrated math, science, and technology education program had a greater tendency to pass the math section of the standardized proficiency test than male students in the non-integrated program.
Note. 35% (N=20) of students who had one integrated course and 57% (N=125) of students who did not have an integrated course did not have math scores, and are not shown in Figure 17.

Figure 17: The distribution of the math scores among male students who had the integrated math, science, and technology education program (N=38) and male students who did not have any integrated math, science, and technology education program (N=96).
Figure 18 shows the number of math attempts among male students who had the integrated math, science, and technology education program and male students who did not have any integrated math, science, and technology education program. Male students who had the integrated math, science, and technology education program tended to have a similar number attempts to pass the math test as to male students who did not have any integration.

Figure 18: The number of math attempts among male students who had the integrated math, science, and technology education program (N=58) and male students who did not have any integrated math, science, and technology education program (N=221).
By looking at Table 4.19, the mean science scores for male students who had the integrated math, science, and technology education program was 205.67, and 199.89 for male students who did not have the integrated program. This showed there was a slight difference between the means of the two groups, but not a significant difference. The standard deviations were used to show variability in the science scores between the two groups. The standard deviations of the science scores for male students who had the integrated math, science, and technology education program was 10.90, and 11.59 for male students who did not have the integrated math, science, and technology program, which showed different variability between the science scores between the two groups.

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integrated</td>
<td>15</td>
<td>205.67</td>
<td>10.90</td>
<td>2.81</td>
</tr>
<tr>
<td>Non-Integrated</td>
<td>37</td>
<td>199.89</td>
<td>11.59</td>
<td>1.90</td>
</tr>
</tbody>
</table>

Table 4.19: The mean science scores and standard deviations for male students who had one or two integrated programs and male students who did not have any integrated programs.

The means and standard deviations were used to report the results of the descriptive statistics of this study. On the other hand, since the researcher assumed that the students in this study could be representatives of a larger population; t-tests were conducted in order to show that the results did not happen due to chance.
**Decision Rule**

The t-test for samples of unequal variances was used, even though Levene’s test for equality of variance showed equal variances, since the samples were of unequal size and had a large difference in their standard deviations. Since the hypothesis is a directional hypothesis, a one-tail t-test was needed in order to analyze the data. If the probability associated with the calculated “t” was equal to or less than alpha, the null hypothesis was rejected, but if the probability associated with the calculated “t” was greater than alpha, the null hypothesis would not be rejected and the means of the two groups would not differ significantly. Table 4.20 showed that the significance value of the one-tail t-test was 0.05. Given that the significance level of calculated “t” was 0.05, which was equal to the alpha level of .05, the null hypothesis was rejected, which meant that the male students who were enrolled in the integrated math, science, and technology education program differ in their standardized proficiency science scores from male students who were not enrolled in the integrated math, science, and technology program.
<table>
<thead>
<tr>
<th>Levene's Test for Equality</th>
<th>t-test for Equality of means</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>sig.</td>
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<tr>
<td>Equal variances assumed</td>
<td>0.717</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td>1.699</td>
</tr>
</tbody>
</table>

Table 4.20: The independent sample test of science for male students who had one or more integrated programs and male students who did not have any integrated programs.
Figure 19 shows the distribution of the science scores among male students who had the integrated math, science, and technology education program and male students who did not have any integrated math, science, and technology education program. The science scores of male students who had the integrated math, science, and technology education program tended to be clustered around the passing score of 200, while the distribution of the science scores for male students who did not have any integration tended to be spread all over the chart. This indicated that the male students who had the integrated math, science, and technology education program had a greater tendency to pass the science section of the standardized proficiency test than male students in the non-integrated program.
Note. 38% (N=30) of male students who had the integrated course and 57% (N=139) of male students who did not have an integrated course did not have science score and are not shown in Figure 19.

Figure 19: The distribution of the science scores among male students who had the integrated math, science, and technology education program (N=28) and male students who did not have any integrated math, science, and technology education program (N=82).
Figure 20 shows the number of science attempts among male students who had the integrated math, science, and technology education program and male students who did not have any integrated math, science, and technology education program. Male students who had the integrated math, science, and technology education program tended to have a similar number of attempts to pass the science test as to male students who did not have any integration.

![Bar graph showing science attempts](image)

Figure 20: The number of science attempts among male students who had the integrated math, science, and technology education program (N=58) and male students who did not have any integrated math, science, and technology education program (N=221).
Looking at question #3 and hypothesis 3.1:

3- Does the integration of math, science, and technology education affect the math and science sub-sections scores of the Ohio proficiency test scores based on ethnicity or race?

3.1- African-American students who are in the math, science, and technology education integrated program will have higher math and science sub-sections of the Ohio standardized proficiency test scores than African-American students who are not in the integrated program.

In light of the data that was collected, there were not enough African American students to test this hypothesis. Therefore, the researcher cannot prove or disprove the effect of the integration of math, science, and technology education program on African-American students' standardized proficiency math and science scores.

3.2- Caucasian students who are in the math, science, and technology education integrated program will have higher math and science sub-sections of the Ohio standardized proficiency test scores than Caucasian students who are not in the integrated program.

In light of the data that was collected and not analyzed for the aforementioned minority groups, the analysis of the Caucasian group was not performed, as it would not contribute useful information to the study.
3.3- Hispanic students who are in the math, science, and technology education integrated program will have higher math and science sub-sections of the Ohio standardized proficiency test scores than Hispanic students who are not in the integrated program.

In light of the data that was collected, there were not enough Hispanic students to test this hypothesis. Therefore, the researcher cannot prove or disprove the effect of the integration of math, science, and technology education program on Hispanic students’ standardized proficiency math and science scores.

3.4- Asian students who are in the math, science, and technology education integrated program will have higher math and science sub-sections of the Ohio standardized proficiency test scores than Asian students who are not in the integrated program.

In light of the data that was collected, there were not enough Asian students to test this hypothesis. Therefore, the researcher cannot prove or disprove the effect of the integration of math, science, and technology education program on Asian students’ standardized proficiency math and science scores.

3.5 American-Indian students who are in the math, science, and technology education integrated program will have higher math and science sub-sections of the Ohio standardized proficiency test scores, than American-Indian students who are not in the integrated program.

In light of the data that was collected, there were not enough American-Indian students to test this hypothesis. Therefore, the researcher cannot prove or disprove
the effect of the integration of math, science, and technology education program on American-Indian students’ standardized proficiency math and science scores.
CHAPTER 5

SUMMARY, FINDINGS, CONCLUSION, AND RECOMMENDATIONS

Summary

The primary purpose of this study was to investigate the relationship between the integration of math, science, and technology education on student performance in the math and science sub-sections of the Ohio standardized proficiency test. This study examined three research questions and ten hypotheses that were formulated around the three questions. The target population was eleventh grade students at a large Ohio suburban High School. The research looked at eleventh grade students when they were in the ninth grade (97-98), and the tenth grade (98-99), in order to determine when students passed the standardized proficiency test. Students were divided into two groups. The treatment group, consisted of the students in the integrated math, science, and technology education program. The control group, consisted of the students in the non-integrated math, science, and technology education program. The research started with 310 students in the eleventh grade. Sixty-eight students were in the integrated math, science, and technology education program, and 242 students were in the non-integrated math, science, and technology education program. After screening the students, the researcher limited the study to those students who were enrolled in January of 2000 and who
attended classes regularly. Thus, students with poor attendance, expelled students, developmentally disabled students, and suspended students were excluded. In the end, the final count of students was 58 in the integrated math, science, and technology education program and 221 in the non-integrated math, science, and technology education program.

**Findings**

**Research Question #1**

1- Does the integration of math, science, and technology education in a selected Tech-prep program have an affect on the math and science sub-sections of the Ohio standardized proficiency test?

1.1-Students who had one course of the integrated math, science, and technology education program will have higher math and science sub-sections of the Ohio standardized proficiency test scores than those students who did not have any integrated program.

1.2-Students who had two or more courses of the integrated math, science, and technology education program will have higher math and science sub-sections of the Ohio standardized proficiency test scores than those students who did not have any integrated program.

1.3-Students who had two or more courses of the integrated math, science, and technology program will have higher math and science sub-sections of the Ohio standardized proficiency test scores than those students who had one integrated course.
Summary. This question was analyzed by using the means and the standard deviations. Also, the researcher assumed that the population in this study was a part of a larger population. Therefore, a t-test was conducted in order to verify that the results did not happen due to chance.

The analysis for Research Question #1 shows that the students in the integrated math, science, and technology education program (Tech Prep) had slightly higher mean scores in the math and science proficiency test, than the students in the non-integrated program. However, this slight difference was not enough of a substantial difference to conclude that students in the integrated math, science, and technology education program (Tech Prep) had higher mean scores in the math and science section of the proficiency test than students who did not have any integrated programs. The analysis of hypothesis # 1.1 shows that there were no substantial differences in proficiency test mean scores of math and science for students who had one integrated math, science, and technology education program (Tech Prep) course and students who did not have any integrated program.

The analysis of hypothesis # 1.2 shows that there were no substantial differences in proficiency test mean scores of math and a significant difference in the mean scores of science for students who had two integrated courses and students who did not have any integrated programs.

The analysis of hypothesis # 1.3 shows that there were not substantial differences in proficiency test mean scores of math and science for students who had two or more integrated courses and students who had one integrated course.
Research Question #2

2- Does the integration of math, science, and technology education affect the math and science sub-sections scores of the Ohio proficiency test based on gender?

2.1- Female students who are in the math, science, and technology education integrated program will have higher math and science sub-sections of the Ohio standardized proficiency test scores than those female students who are not in the integrated program.

2.2- Male students who are in the math, science, and technology education integrated program will have higher math and science sub-sections of the Ohio standardized proficiency test scores than those Male students who are not in the integrated program.

Summary. This question was analyzed by using the means and the standard deviations. Also, the researcher assumed that the population in this study was a part of a larger population. Therefore, a t-test was conducted in order to verify that the results did not happen due to chance. The analysis for Research Question #2 shows that male and female students in the integrated math, science, and technology program (Tech Prep) had slightly higher mean scores in the math and science proficiency test than the students in the non-integrated program. However, this slight variation was not enough of a substantial difference to conclude that the students in the integrated math, science, and technology education program (Tech Prep) had higher mean scores in the math and science section of the proficiency test than students who did not have any integrated
programs. The analysis of hypothesis # 2.1 shows that there were no substantial differences in proficiency test mean scores of math and science between female students who had the integrated math, science, and technology education program (Tech Prep) and female students who did not have any integrated program.

The analysis of hypothesis # 2.2 shows that there were no substantial differences in proficiency test mean scores of math for male students who had the integrated math, science, and technology education program (Tech Prep) and male students who did not have any integrated program. On the other hand, the researcher found a significant difference in the mean scores of science between male students who had the integrated math, science, and technology education program (Tech Prep) and male students who did not have any integrated program.

Research Question # 3

3- Does the integration of math, science, and technology education affect the math and science sub-sections scores of the Ohio proficiency test based on ethnicity or race?

3.1 African-American students who are in the math, science, and technology education integrated program will have higher math and science sub-sections of the Ohio standardized proficiency test scores than African-American students who are not in the integrated program.

3.2 Caucasian students who are in the math, science, and technology education integrated program will have higher math and science sub-sections of the Ohio standardized proficiency test scores than Caucasian students who are not in the
integrated program.

3.3- Hispanic students who are in the math, science, and technology education integrated program will have higher math and science sub-sections of the Ohio standardized proficiency test scores than Hispanic students who are not in the integrated program.

3.4- Asian students who are in the math, science, and technology education integrated program will have higher math and science sub-sections of the Ohio standardized proficiency test scores than Asian students who are not in the integrated program.

3.5- American-Indian students who are in the math, science, and technology education integrated program will have higher math and science sub-sections of the Ohio standardized proficiency test scores than American-Indian students who are not in the integrated program.

Summary. This question was analyzed by using the means and the standard deviations. Also, the researcher assumed that the population in this study was a part of a larger population. Therefore, a t-test was conducted in order to verify that the results did not happen due to chance.

The analysis for Research Question #3, the researcher could not find enough data for African American, Hispanic, Asian and American Indian students in order to test the effect of the integrated or non-integrated program in their math and science proficiency test scores. Also, in light of the data that was collected and not analyzed for the aforementioned minority groups, the analysis of the Caucasian group was not performed, as it would not contribute useful information to the study.
The analysis of hypothesis # 3.1 shows that the researcher did not have substantial data set for African American students in order to test the effect of the integrated or non-integrated program in their math and science proficiency test scores. The analysis of hypothesis # 3.3 shows that the researcher did not have substantial data for Hispanic students in order to test the effect of the integrated or non-integrated program in their math and science proficiency test scores. The analysis of hypothesis # 3.4 shows that the researcher did not have substantial data for Asian students, in order to test the effect of the integrated or non-integrated program in their math and science proficiency test scores. The analysis of hypothesis # 3.5 shows that the researcher did not have substantial data for American-Indian students, in order to test the effect of the integrated or non-integrated program in their math and science proficiency test scores. The analysis of hypothesis # 3.2, for the Caucasian group, was not performed, as it would not contribute useful information to the study.

**Discussion of Findings**

The primary purpose of this study was to investigate the influences of the integrated math, science, and technology education program on students’ performances on the state of Ohio math and science sub-sections of the 9th grade proficiency test. The researcher felt that more schools should have been involved in this study, in order to see if there was a wider effect of the integrated math, science, and technology education program on students’ math and science sections of the proficiency test. Furthermore, the researcher expected that the outcomes of this study would help to convince school
administrators and math, science, and technology education instructors about the good aspects of the integration of math, science, and technology education program. The only significant differences were found on the mean scores of science for students who had two or more courses in the integrated math, science, and technology program and of whom were male students. Moreover, the researcher did not find any substantial amount of data in order to examine the effect of the integration of math, science, and technology education on African American, Hispanic, Asian, and American Indian students. Also, in light of the data that was collected and not analyzed for the aforementioned minority groups, the analysis of the Caucasian group was not performed, for it would not contribute useful information to the study.

In this study, the researcher found that students who had two or more integrated courses had higher mean scores of science than students who had one integrated course. This finding is similar to the study of Brusic's (1991) which did not show any significant finding between the treatment and the control groups. Brusic's (1991) integrated group did not differ in the level of achievement from the non-integrated group. However, Brusic found that female students in the treatment group had higher achievement scores, than the control group. This research differs from Brusic's findings, in that the researcher found that male students in the integrated math, science, and technology education program had higher mean scores of science than students in the non-integrated program.

Childress's (1994) dissertation study did not discover any significant findings between the treatment group (received correlated instruction with science and mathematics) and the control group (did not receive correlated instruction with science
and mathematics). Similarly, in this study, the researcher did not find any substantial
differences between students who had only one course in the integrated math, science,
and technology education program and students who were in the non-integrated program.
Dissimilarly, the researcher did find a significant difference for students who had two or
more courses of the integrated math, science, and technology education program.

**Conclusions**

The purpose of this study was to investigate the relationship of the integration of
math, science, and technology education on student performance on the math and science
sub-section of the Ohio standardized proficiency test. Students who had two or more
courses in the integrated math, science, and technology education program scored
significantly higher on the science sub-section of the standardized proficiency test than
students who did not have any integration. This difference was also observed when male
students were compared. The research did not find significant differences in math scores
on the Ohio standardized proficiency test for students who had the integrated math,
science, and technology education courses. Also, the research did not find significant
differences in science scores for students who had only one course of the math, science,
and technology program. Moreover, students who had the integrated math, science, and
technology education program needed fewer attempts to pass the math and science sub-
sections of the Ohio standardized proficiency test, than students who did not have any
integration which, indicated a positive effect of the integration of math, science, and
technology education program.
Recommendations

As a result of this study, the following recommendations were made for future study of the effectiveness of integrating math, science, and technology programs:

1- Future studies using the Ohio 9th grade proficiency test should not include the 1997 school year. Prior to 1998, the results of the standardized proficiency test scores were posted as pass or fail; no numerical data is available.

2- The researcher should randomly sample the students in order to have a more accurate representation of the school population.

3- A larger number of schools should be involved in future studies, in order to see if there is a wider effect of the integrated math, science, and technology education program.

4- When selecting a population for future studies, the researcher should select schools that include students with a wide variety of ethnic backgrounds and over sample in order to represent all ethnic backgrounds.

5- Future research should select students for the study and over sample in order to accurately represent both genders.

6- Future research should be done using different standardized tests, such as SAT and ACT.

7- Future research should look at other means of assessing students' math and science performance knowledge, such as homework, teacher made test scores, and grades.
Appendix A

Human Subjects Institutional Review Board
Appendix B

Letter of Support from the Target High School
Dear Sir or Madam,

This letter is written to affirm my willingness to aid Yousef Ebrahim in the collection of data at School.

I would identify those students in Tech Prep Block who are now 11th grade students and a control group of students that attended School but did not participate in a integrated block experience.

I would also work with Mr. from our central office to facilitate this study.

My participation is contingent on approval of both OSU and City Schools.

Sincerely,

[Signature]

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Appendix C

Letter of Support from the School District
To: The Ohio State University  
    Human Subject Review Committee

Fr:  

Re: Yousef Ebrahim Study Data  

Date: January 25, 2000

As Testing Coordinator for the City Schools, I can provide Ninth Grade Proficiency Test data on the 11th grade students selected for this study as follows:  
    - Passing Status for each of the five tests  
    - Current scale score for each test  
    - The number of times the test was (has been) attempted  
    - If passed, the date of the passing effort - if not passed, the date last attempted  
    - GPA of student thru 5 semesters  
    - Race  
    - Sex

[Signature]

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